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CONTENTS

The Relation of Electrical Engineering to other Professions: GANO DUNN 161

Honorary Degrees at the University of Michigan 166

The Funeral of M. Henri Poincaré 167

Scientific Notes and News 168

University and Educational News 171

Discussion and Correspondence:—

Zoological Nomenclature: PROFESSOR J. S. KINGSLEY. *Dome Theories as applied to Gulf Coast Geology:* PROFESSOR G. D. HARRIS 171

University Control:—

Letters from Cornell University; Letters from the University of Chicago 174

Scientific Books:—

Nutting's Outlines of Applied Optics: PROFESSOR W. LECONTE STEVENS. *Scharff on the Distribution and Origin of Life in America:* PROFESSOR ALEXANDER G. RUTHVEN. *Recent Antarctic Work:* DR. W. H. DALL . 186

Special Articles:—

A Case of Sex-linked Inheritance in the Domestic Pigeon: PROFESSOR LEON J. COLE. *The Intertubercular or Bicipital Foramen of the Humerus of the Guinea-pig:* PROFESSOR LEONARD W. WILLIAMS 190

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THE RELATION OF ELECTRICAL ENGINEERING TO OTHER PROFESSIONS[1]

ON the wall of a great engineering library is the legend "Engineering is the art of organizing and directing men, and of controlling the forces and materials of nature for the benefit of the human race." This is broad and all-embracing, but other professions will find it hard successfully to quarrel with it. While the immediate object of engineering is a material one, engineers draw from many different channels of human energy, such as generalship, commerce, psychology, mechanics, economics, to say nothing of chemistry and physics and many others, all under an interpretation, insight and method that are best described by the term scientific.

It may be asked, Why could not a similar statement of embrasure or scope apply to medicine, the law, the army and other professions? In part it could, but it is to engineering that it applies preeminently. The subject-matter of the older professions, the things about which they busy themselves, and the objects they seek to accomplish have changed relatively little in many centuries. The means have altered but the ends persist. They are approximately the same to-day as they have been throughout history and tradition. With engineering it is different. There was no such profession a hundred and fifty years ago, and if I may a little anticipate my conclusion, there will be no such profession a hundred and fifty years hence in respect to a large part of what we now call engineering.

[1] President's address presented at the twenty-ninth annual convention of the American Institute of Electrical Engineers, Boston, Mass., June 25, 1912.

Such as it is, engineering is embracing an ever-growing horizon, and is including more and more of the activities of civilization. When I say activities I refer to material ones and not to the whole of life itself. The human spirit is the greatest fact in the world, and art and literature that interpret it, the acts of our daily life and our personal relations that depend upon it, religion and the vast body of our social and political experience, that go to constitute life form undoubtedly a mass of activities, which are greater, in terms of consciousness, than the material activities which engineering can affect. In other words, the humanities which have been the same for ages can never be invaded by anything that merely rearranges our relations to the material world.

In the material world, however, which is at once the workshop and the throne, the glory and the limitation of the engineer, marvel has followed marvel and shall be followed by more marvels, for we are beginning to catch the tools' true play; beginning to see the vision of our dominion over the earth. Whether it really is engineering to organize men, to predict the psychology of a fare-paying population, to win the endorsement of a labor union, to treble the yield of a farm by a microscope, all of which successes to-day are called engineering, depends upon the definition that we finally adopt.

It is startling to study the variety and importance of the posts filled by engineers and to note the range of what they do. From the efficiency engineer presenting surprises in the output of a factory where the human factor is large, or the industrial engineer suddenly after thousands of years showing the world how to increase greatly the lay of bricks, or the agricultural engineer working miracles with the soil that for ages farmers have struggled with, to the civil engineer establishing a kingdom and building the Panama Canal, we have instances in which the engineer is doing more and more of the world's work.

The history of this class of men so rapidly growing in numbers, so rapidly differentiating in function is almost a romance. The "Encyclopedia Britannica" names the middle of the eighteenth century—that is, 1750—as the time before which there were only military engineers—who constructed "engines" of war—and it adds that at about that time there began to arise a new class. Little did this new class realize the army it was leading down the industrial paths of time!

The "new class" has surpassed all bounds. From insignificance a hundred and fifty years ago it has increased almost incredibly in numbers and variety of specialization. As a local indication, the Engineering Societies' Building in New York is the headquarters of fifty thousand engineers. As another local indication, the American Institute of Electrical Engineers has in the last ten years increased six fold. The growth in the variety of specialization has been almost as rapid as the increase in numbers. Where there were only military engineers and the "new class" a hundred and fifty years ago, there are twenty-seven recognized varieties to-day. Without mentioning all, they range from civil through mechanical, electrical, mining, illuminating and chemical, to refrigerating, industrial, agricultural and aeronautical. There is even a magazine with the title *Human Engineering*.

A large and increasing part of the capacity of our colleges and universities is devoted to the education of engineers. Parts of the engineering curricula are borrowed for what used to be purely classical courses. The metaphors of the speech of the day often have an engineering basis

and—we have a McAndrews hymn. The man in the street knows something about spark plugs, and many women understand the general principles of the telephone. The social status of the engineer has emerged from that of a mechanic to one nearly as high as that of the clergyman, the physician or the lawyer.

Relatively recently there has been going on simultaneously with all this, however, hardly noticed, something else—a vast increase in so-called engineering work by men who are not engineers, and at the same time a large drawing off into executive, administrative, industrial, commercial, civic, educational, financial and even legal callings, of men of engineering training. A history of segregation and disintegration seems to have begun to accompany a history of integration and building up.

For one to say to-day he is an engineer gives very little idea of what he actually does. It does not locate him in one of the twenty-seven recognized classes. It leaves it possible for the hearer to think of him as a "social engineer" or an "efficiency engineer" should he not look like a "civil engineer"; but even if he did define himself and say he was an electrical engineer, the hearer would still not know whether he represented the last word on the loading of telephone circuits or his responsibility was to determine whether the great railroad terminals of Chicago should use a third rail or an overhead catenary. If he should say "I am a teacher," "a physician," "a clergyman," "a lawyer," there would be a much more definite conception attaching to his answer. There must be, therefore, in the title "engineer" something broader, something not included, or included to a lesser degree, in the titles of the other professions or occupations.

A light is shed if we examine the popular definition that engineering is "educated common sense." Can it be that unlike "physician," "lawyer," "teacher," the term "engineer" does not describe what a man *does*, but rather *how* he does it! A method rather than an occupation! It is even so; that is, essentially and with limitations I shall refer to later.

What then is this "method" that has given the engineer his ever broadening domain and brought all kinds of men and callings to his school? He can tell you at once. Here is where he is defined and where his fellows recognize him and each other though they come from the ends of the industrial earth as to diversity of actual occupation. The method had its birth in Greece, though it was stifled almost to death by the tremendous philosophic, humanistic and artistic energies of the Hellenes. Later it was buried in Europe under the irruption of the barbarians. The names of Thales, dear to our profession, with his "elektron," and of Aristotle and Archimedes, stand out as having done much for it—especially Archimedes—in spite of the humanistically polarized intellectual atmosphere in which they lived and which they contributed so gloriously to create.

But the Greeks made only a start. To quote an authority, their material thinking was largely based on what has proved to be a wrong method of procedure, the introspective and conjectural rather than the inductive and experimental. They investigated nature by studying their own minds, by considering the meanings of words, rather than by studying things and recording phenomena. But they saw much of the light with all this. Though absolutely dead for a thousand years in Europe, "the method" was kept alive during the middle ages in Arabia, although confused with magic, alchemy and algebra. Then came Roger Bacon, Leonardo da Vinci and

Copernicus, and science as we know it began to take shape.

Aristotle had sat down in his chamber and he wrote in a book, "A body twice as heavy as another of course falls twice as fast." Galileo released simultaneously from the top of the Leaning Tower a one-pound and a one-hundred-pound shot and they reached the earth together, before the eyes of the assembled University of Pisa. But "the method" was repugnant to the university, and almost to a man they believed their Aristotle, sophistically explained away what they saw, and persecuted Galileo. Descartes, Newton, Lagrange, Laplace, Francis Bacon connote to engineers the transcendent story, unless for electrical engineers there should be added Ampère, Faraday, Henry, Helmholtz, Kelvin.

The method of doing things that makes an engineer is, therefore, the applying to practical and utilitarian ends the principles and reasoning of science. Engineering is not science, for in science there is no place for the conception of utility. Truth is her sole criterion. In the exalted language of Professor Keyser, "Not in the ground of need, not in bent and painful toil but in the deep-centered play-instinct of the world science has her origin and root; and her spirit, which is the spirit of genius in moments of elevation, is but a sublimated form of play, the austere and lofty analogue of the kitten playing with the entangled skein or of the eaglet sporting with the mountain winds."

Engineering is science's handmaid following after her in honor and affection, but doing the practical chores of life, concerned with the useful and the material; with costs and with expediency, and concerned with the humanities only in so far as they are an incident in some particular scheme of reality, and then objectively, if that may be said. Her methods merely apply straight thinking to material problems for useful purposes.

Does this constitute a profession? No. Some day it will be the way almost everybody thinks instead of a body of specialists and then the difference between a doctor, for instance, and an engineer, will be only in the things they busy themselves about; as is to-day the only difference between kinds of engineers.

The center of education has been shifting rapidly recently—almost as rapidly as material well being has been increasing. The application of science to living has marked an age as distinct as the age of the climax of art in Greece. The "new class" has been but a pioneer in sowing the seeds of scientific rationalization in a field the value of which was only dreamed of by Archimedes and not actually recognized until, as the encyclopedia tells us, "about the middle of the eighteenth century," when the "new class" began to arise. And now, as to the limits within which engineering is a method rather than an occupation.

There will always be engineers, for the methods of science will constantly advance, and there will be needed continually, to interpret and transmit them to mankind, and to make the first applications of them to useful purposes, a class of men who, by instinct and taste, as well as by the possession of what I later shall call the dynamic component, find easier than other men—and consequently perform better—the kind of scientific thinking, observation and action that characterize engineers to-day.

What these men will be busy about it is hardly safe to say, although it is probable the present great divisions of engineering will be more or less preserved. It seems certain that a large mass of knowledge that now is called engineering and forms the basis of many of the engineering spe-

cializations, will become general knowledge, and will be absorbed by the community, partly as a result of the shifting of the center of education and partly through every-day familiarity, and the men possessing this knowledge will no longer be called engineers. They will be called farmers, let us say, in the case of the "agricultural engineer"—of course, a farmer of a very advanced kind compared to the earlier one.

But the center of education will not always continue to shift. It is shifting now only because it has so long been eccentric. It would be a calamity for it to shift too far, resulting in a world whose sole training was applied science and the utilities. Under such a condition, engineering and the utilities themselves would languish instead of flourishing, for there would be lacking in engineers the dynamic component.

Ample knowledge, insight, information does not make an engineer. He must first be a man. Engineering is not thought like philosophy; it is thought times action, and only when the qualities of action are developed approximately to the same extent as the qualities of thought is an engineer at his best. Only then is his area of effect a maximum. The qualities of action involve tastes and personality, the feelings, the will. And it is these that constitute the component or factor that makes an engineer's intellectual or rationalizing equipment dynamic—that puts it to use.

It was partly the intense appreciation of the value of the dynamic component that led the Greeks and successive centuries astray in the direction of their education and contributed to an underestimate of the importance of science and the study of the laws of nature. We must not go to the equally wrong other extreme.

So far I have said but little of electrical engineering. It must be brought in if for no other purpose than to justify our title. Although the article on "Engineering" in the "Britannica" occupies only six inches of one column, it concludes with the following: "The last great new branch is *electrical* engineering, which touches the older branches at so many points that it has been said that all engineers must be electricians." If engineering is a method of doing things, and electrical engineering tends to embrace all other branches, there is an implication that electrical engineering is the latest or most highly developed form of the method—the method that is the utilitarian application of the principles of science to the material facts of life.

Such is unquestionably the case. Born scarcely more than twenty-five years ago, the "youngest branch," electrical engineering, had the opportunity of striking its roots into the richest of scientific soils, free from prejudices, customs or traditions. It had no entangling alliances, no political laws to retard or encumber it. The field it preempted was the terra nova of engineering, the new world of applied science.

Under the influence of those geniuses of science, Volta, Faraday, Ampère, Ohm, Kelvin, Helmholtz, Maxwell, Oersted, Henry, and with the metric system for its cornerstone, there developed a comprehensive structure of thought and a related scheme of units. The latter are the admiration of the world for their simplicity, their convenience, their precision and their reproducibility. The scientific method as applying to all phenomena acquired its most perfect embodiment in the electric system and its relations.

But there is a philosophical debt that we electrical engineers owe our units. They school our minds. The ability to measure with precision difficult and complicated quantities enables clear thinking on them and renders reasoning about them possible

that otherwise could not be attempted. To name a thing is to know it. The wonderful electrical units are a fluent language that gives the widest opportunity to thought. By their character they educate our faculties of definition and of relation. They typify all quantitative thinking, not merely electrical. They are the epitome, the last word of the great minds of our age, as to what the scientific method of thought is, in relation to the whole realm of matter and force.

Therefore although the subject matter of electrical engineering is covering a wider and wider range—so wide as to be almost incongruous—the electrical method of thinking is applicable throughout. It is spreading far beyond. As an electrical engineer, I even find myself thinking of the crowds passing in the streets in terms of amperes and volts, and of the fluctuations of the stock market in terms of current, inductance, capacity, resistance and resonance.

That which can impose form upon our thought enables us successfully to think of any kind of thing. The forms of thought established for electrical engineering are at once so comprehensive, so rigid, so rich in detail, and so illuminating that engineering does not bound them. They may be called the manifestation of science in civilization, the best representation of the scientific method at work for utilitarian ends. They prove that the profession of electrical engineering not only deals with single-phase motors, storage batteries, high-tension transmissions, turbo generators, coronas, carbon transmitters and commutation, *as an occupation,* but that it also is a *way of thinking,* and as such is not an occupation, but the latest and most highly developed scientific method of solving all kinds of practical problems of matter and force, for the benefit of the human race.

Gano Dunn

HONORARY DEGREES AT THE UNIVERSITY OF MICHIGAN

On the occasion of the celebration of the seventy-fifth anniversary of the University of Michigan honorary degrees were conferred by vote of the senate council and board of regents on graduates of the university and former members of the university senate. The doctorates conferred on scientific men with the accompanying remarks were as follows:

THE DEGREE OF DOCTOR OF SCIENCE

Edward Allen Fay, of the class of 1862, educator, editor, one of the foremost Dante scholars in this country and historian of American schools for the deaf.

Doctor John Elmer Weeks, of the class of 1881, department of medicine and surgery, now professor of ophthalmology in New York and Bellevue University, joint discoverer of the Koch-Weeks bacillus.

Doctor John Jacob Abel, of the class of 1883, professor of materia medica and therapeutics in the department of medicine and surgery of this university from 1891 to 1893, now professor of pharmacology in Johns Hopkins University, distinguished for his researches and original contributions.

Doctor Henry Sewall, professor of physiology in this university from 1882 to 1889, now professor of physiology in the University of Colorado, whose research on immunization to the venom of the rattlesnake done while a professor in this university laid the foundation for the discovery of diphtheria antitoxin.

Bryant Walker, of the class of 1876, a man who, though a busy lawyer, has found the time to make himself well and favorably known for his published work on molluscs, a world authority on the group.

Charles Francis Brush, of the class of 1869, department of engineering, the earliest pioneer in the field of electric lighting, inventor of modern arc electric lighting, honored many times at home and abroad for his scientific achievements.

THE DEGREE OF DOCTOR OF ENGINEERING

George Henry Benzenberg, of the class of 1867, department of engineering, past president of the American Society of Civil Engineers, a noted authority on the construction of water works, distinguished civil engineer and citizen.

Cornelius Donovan, of the class of 1872, depart-

ment of engineering, a profound student of river hydraulics, a faithful servant of the United States government for thirty-eight years, and distinguished as the builder of the great jetties at the mouth of the Mississippi River.

THE DEGREE OF DOCTOR OF LAWS

Doctor William Henry Howell, of Johns Hopkins University, professor of histology and physiology in the University of Michigan from 1890 to 1892, distinguished teacher and investigator, a physiologist of the first rank.

Professor Andrew Cunningham McLaughlin, of the class of 1882, for many years a member of the historical staff of his alma mater, now professor and head of the department of history in the University of Chicago, a distinguished teacher whose published contributions have placed him in the front rank of American historical scholars.

Doctor James Playfair McMurrich, for thirteen years professor of anatomy in the University of Michigan, now professor of anatomy in the University of Toronto, distinguished as a teacher and for learned contributions to the sciences of biology and anatomy.

Henry Smith Carhart, for over twenty years professor of physics in the University of Michigan, now a worthy recipient of the honors of the Carnegie Foundation, distinguished as scholar and author and for his service in the cause of international electrical units and standards of measurements.

Robert Simpson Woodward, a graduate of the University of Michigan in the class of 1872, since 1905 the president of the Carnegie Institution of Washington, engineer, astronomer, geographer, physicist, a renowned investigator of problems in the solution of which the whole world is interested.

THE FUNERAL OF M. POINCARÉ

THE funeral of M. Henri Poincaré took place on July 19. After religious ceremonies at the church of Saint-Jacques-du-Haut-Pas the procession passed to the cemetery of Montparnasse, where eulogies were delivered by the minister of public instruction, speaking for the government and the university, M. Claretie for the French Academy, M. Appell for the Faculty of Science, by M. Bigourdan for the Bureau of Longitudes, by M. Painlevé for the Academy of Sciences and General Cornille for the Polytechnic School. From *Nature* we learn that the pall-bearers were MM. Guist'hau, minister of public instruction, Jules Claretie, Lippmann, Appell, Bigourdan, General Cornille, Painlevé and Zeiller. The hearse was covered with wreaths which had been sent by the staff and teachers of the Ecole Polytechnique, the Faculty of Science, the French Physical Society, the Observatory of Meudon, the Association of Pupils and Past Pupils of the Faculty of Science, the General Association of Students, the French League of Moral Education, etc. The chief mourners were MM. Léon Poincaré, son of the deceased; Emile Boutroux, his brother-in-law; Raymond Poincaré, President of the Ministerial Council, and Lucien Poincaré, Director of Secondary Education and Minister of Public Instruction, his cousins. There were also present: Captain Grandclément, representing the president of the republic; MM. Antonin Dubost, president of the senate; Klotz, minister of finance, and Lebrun, minister for the colonies; the representatives of the president of the chamber, MM. Steeg, Fernand David, Briand, Jean Dupay, Pams, René Besnard and Léon Bérard, members of the government; the delegacy of the French Academy, consisting of MM. Jules Claretie, director; Henri Roujon, treasurer; Thureau-Dangin, permanent secretary; Denys Cochin, the Marquis de Ségur, Masson, and Marcel Prévost; the delegacy of the Academy of Sciences, consisting of MM. Lippmann, president, Darboux and van Tieghem, permanent secretaries; Émile Picard, Painlevé, Humbert, members of the section of geometry; the members of the higher council of public instruction, the members of the council of the university; the delegacy of the professors of the faculty of science, consisting of MM. Andoyer, Goursat, Kœnigs, Abraham, Cartan, Borel, Pinseux, Houssaye and Perrin; a delegacy of members of the corps des mines, of the bureau des longitudes, of the association of pupils and past pupils of the faculty of science; Sir J. Larmor, senior secretary, and Mr. Dyson, representing the Royal Society of London; the mayor and the deputy-mayors of the fifth

arrondissement; the Prince of Monaco, Prince Roland Bonaparte; MM. Liard, vice-rector of the University of Paris; Baillaud, director of the Paris Observatory; Deslandres, director of the Observatory of Meudon; Mgr. Duchesne, director of the École Française de Rome; Paul Hervieu, Henri de Régnier, Louis Passy, Joseph Reinach, Georges Perrot, René Doumic, Mmes. Milne-Edwards, Émile Ollivier, Professor Hutinel and others.

SCIENTIFIC NOTES AND NEWS

The following lectures will be delivered at the International Congress of Applied Chemistry to be held in New York in September: "The Rôle of the Infinitely Small in Biological Chemistry," by M. G. Bertrand, of Paris; "Oxidation of Atmospheric Nitrogen in Norway," by Dr. S. Eyde, of Christiania; "The Most Recent Problems of Chemical Industry," by Dr. C. Duisberg, of Elberfeld; "Permanent Fireproofing of Cotton Goods," by Professor W. H. Perkin, F.R.S., of Manchester; "Synthetic Ammonia," by Dr. H. A. Bernthsen, of Ludwigshafen; "The Photochemistry of the Future," by Mr. G. Ciamician, of Bologna, and "Priestley in America," by President Ira Remsen, of the Johns Hopkins University.

Professor von Wassermann has been appointed head of an institute for experimental research on cancer established by the Kaiser Wilhelm Society for the Promotion of Science.

The Vienna Academy of Sciences has conferred its Lieben prize for 1912 on Dr. Oswald Richter for his work on the food of algæ.

The medal of the Royal Bavarian Academy of Science has been awarded to Dr. C. C. Hosseus, of Berchtesgaden, for his journey in Siam.

The Schaudinn medal has been awarded to Dr. Chagas, of the Institut Oswaldo Cruz, at Rio de Janeiro, for his discovery of the trypanosome responsible for epidemic thyroiditis.

Professor Carl Binz, formerly director of the Pharmacologic Institute at Bonn, celebrated his eightieth birthday July 1.

In the geological survey at Berlin, Drs. Oskar Tietze Wilhelm Wunstorf and Leo Siegert have been promoted to be geologists.

Col. William C. Gorgas has declined the invitation to become chairman of the Boston Board of Health.

Dr. Alexander N. Winchell has resigned from the United States Geological Survey in order to resume work as a consulting mining geologist. He has recently returned to his office in Madison, Wisconsin, after spending several weeks in Nevada in connection with litigation regarding the ownership of the ore deposits of the national mine in that state.

Assistant Dean W. T. Bawden, of the College of Engineering of the University of Illinois, has resigned and will take up special graduate work at Teachers College of Columbia University in education.

Dr. Edwin D. Starbuck, professor of philosophy in the State University of Iowa, has been granted sabbatical leave for the coming year, and will reside in Boston. He will act for the year as psychologist adviser to the *Beacon Press* in the publication of children's and young people's literature, and especially in the formation of the graded Sunday-school curriculum.

Professor William S. Dietrich, head of the division of swine husbandry at the University of Illinois, has resigned to become superintendent of a stock farm.

Dr. Mel. T. Cook, professor of plant pathology at Rutgers College, gave a lecture before the students at the Biological Laboratory of Cold Spring Harbor, L. I., on the "Immunity of Plants to Disease," on July 29, 1912.

Dr. E. F. Bashford, director of the Imperial Cancer Research Fund, will deliver the von Leyden memorial lecture in Berlin on October 21. As already announced he will give the Middleton Goldsmith lectures before the Pathological Society of New York on October 2, 3 and 4.

Professor Theobald Smith, of Harvard University, gave his last lecture as visiting professor to the University of Berlin on June 23.

THE presidents of the Royal Society and the Royal College of Surgeons some weeks ago took the necessary steps for the formation of a large and representative committee for the purpose of establishing a memorial to the late Lord Lister. A meeting of this committee, which was largely attended, was held on July 22 at the rooms of the Royal Society, under the chairmanship of Sir Archibald Geikie. The following were appointed an executive committee to recommend to a future meeting of the general committee a scheme for the memorial to Lord Lister and to organize an appeal for subscriptions: The Archbishop of Canterbury, the Lord Chancellor, Lords Iveagh, Rayleigh, Rothschild and Alverstone, the dean of Westminster, the Lord Mayor, the Lord Provosts of Edinburgh and Glasgow, the Master of the Rolls, Mr. Lewis Harcourt, M.P., Sir T. Barlow, Sir W. W. Cheyne, Sir R. J. Godlee, Sir H. Morris, Sir A. Geikie, Sir D. MacAlister, the Hon. Sir C. Parsons, Sir W. Turner, Sir J. Wolfe-Barry, Sir J. R. Bradford, Sir A. P. Gould, Sir A. Kempe, the Hon. W. F. D. Smith, Mr. F. M. Fry and Mr. Edmund Owen. Lord Rothschild and Sir W. W. Cheyne were appointed treasurers and Sir J. R. Bradford was appointed secretary of the Lister Memorial Committee.

A TABLET is to be erected at the University of Liverpool in memory of the late Sir Rubert Boyce.

A COMMITTEE has been organized to erect a monument to J. Janssen, the astronomer and astrophysicist, the founder of the observatory on the summit of Mont Blanc.

AT a meeting of the French Academy on July 17 M. Jules Claretie, who presided, delivered an address in memory of M. Henri Poincaré. The meeting then adjourned as a tribute of respect.

MR. JAMES DUNN, a distinguished British naval architect, died on July 17, aged seventy-five years.

THE death is also announced of Mr. Andrew Lang, known for his contributions to anthropology and eminent for his literary and critical work.

DR. JOHANNES CHATIN, professor of histology at Paris, has died, aged sixty-five years. He was the son of the celebrated botanist, Gaspard-Adolphe Chatin, and was known for his work on comparative anatomy and helminthology.

DR. LUDWIG GANGLBAUER, director of the zoological department of the Royal Natural History Museum at Vienna, died on June 5.

THE United States Civil Service Commission announces an examination to fill a vacancy in the position of assistant physical geologist, Geological Survey, Washington, D. C., at an entrance salary of $1,500 per annum; metallographist in the Bureau of Standards at a salary of $1,800 per annum; pomologist in the Bureau of Plant Industry, at a salary of from $1,800 to $2,500 per annum, and assistant dairyman qualified in creamery operation and butter making, at $1,500 to $1,740 per annum, in the dairy division, Bureau of Animal Industry.

THE ninth International Congress of Zoology is to be held at Monaco from March 25 to 30, 1913.

THE *Journal* of the American Medical Association states that the preliminary program of the Pellagra Conference which is to be held in Columbia, S. C., October 3–4, includes an address to be given by Surgeon-General Rupert Blue; a preliminary report by the Thompson-McFadden Commission on Epidemiology of Pellagra, and other papers dealing with the prevalence, geographic distribution, artificial production and other subjects of general interest in regard to this wide-spread disease.

THE new Hamburg Observatory built on the Gojenberg, near Bergedorf, of which Professor Scharr is director, has been dedicated.

IT is proposed to acquire the estate of Corstorphine Hill as the site of zoological gardens for Edinburgh at a cost of $85,000.

ON July first, the beginning of the fiscal year for the University of California, the property and general management of the Marine Biological Station of San Diego passed formally into the hands of the regents of the university, and hereafter the station under

the new name, The Scripps Institution for Biological Research of the University of California, will be a department of the university. All details of management and determination of scientific policy will, however, be by a local board at San Diego. Miss Ellen B. Scripps, already a benefactor of the institution to a large amount, has signified her willingness to add liberally to her gifts, and new developments will be begun at once. Additions to the library, a wharf, the salt water pumping plant and housings for those connected with the laboratory, will be provided as rapidly as the plans can be perfected. As a step preparatory to the new work a survey of the 100-acre tract of land owned by the institution, and on which the laboratory stands, will be made for the purpose of laying out roads and locating the sites of the projected dwelling houses.

News reached Copenhagen early in May, as we learn from the *Geographical Journal,* of the arrival at Maskat of Mr. Barclay Raunkiær, a Danish traveler, who set out for that country in November, 1911, under the auspices of the Royal Danish Geographical Society. The explorer traveled from Aleppo *viâ* Baghdad to Basra, which he reached on January 22. From Koweit (where he was well received by the regent) his intention was to go south to Riad in the Wahabi country, and thence to make his way back to the Persian gulf by an eastward route through the Hofuf oasis. According to the preliminary announcement he appears to have successfully carried out this program, and to have secured valuable anthropological, zoological and botanical observations, besides mapping the country traversed. Mr. Raunkiær is known as a writer on the geography of plants, and for a previous journey made by him in Central Tunis.

The volcanoes of Alaska are not all dead, and those that smoke are held in dreadful awe by the natives. As late as 1883 Mount Augustine, a volcanic cone which rises 4,000 feet out of the waters of Cook Inlet, was in violent eruption, and Mount Iliamna and Mount Redoubt, about 10,000 feet high, towering above the coast range, were in eruption in 1854 and 1902, respectively. Lake Iliamna is the largest freshwater body in Alaska. It is 80 miles long by 8 to 20 miles wide—somewhat larger, perhaps, than Long Island Sound. Its bottom is far below sea level. The altitude of its surface is only 50 feet above the ocean, but soundings at its upper end indicate a depth of many hundred feet. North of and tributary to Iliamna Lake is Clark Lake, more than 50 miles long, but narrow. This lake is 220 feet above the ocean tides, but in places is more than 600 feet deep. The region containing these volcanoes and lakes was the scene of very early missionary endeavors and trade exploitation by the Russians. Nevertheless little exact knowledge of the region has been acquired, and that has been largely inaccessible to the public, so that the recent investigations by the United States Geological Survey, a report of which has just been published as Bulletin 485, entitled "A Geological Reconnaissance of the Iliamna Region, Alaska," by G. C. Martin and F. J. Katz, should be very welcome. This report describes the geographic and geologic features and the mineral resources of an area covering more than 5,000 square miles lying west of Cook Inlet. It discusses the mountain systems, the lakes, rivers and glaciers. The climate and vegetation, particularly the distribution of forests and the cause of the limits of the forests, are considered. Transportation routes are indicated. The geology is treated at considerable length, and so also the prospective mineral resources, which are copper, gold, silver and petroleum. None of these minerals have yet been shipped from this district, but the region may neverthless some day become important commercially. The report should be of value to those who are interested in the mineral prospects and to those who intend to search for similar deposits in other parts of the district, as it describes the known mineral deposits and the geology of the region containing them. The report is accompanied by topographic and geologic maps in colors on a scale of 4 miles to the inch and by numerous smaller maps, sections and views.

UNIVERSITY AND EDUCATIONAL NEWS

THE sum of £3,000 has been left to the University of Belfast by Mrs. F. Magrath for the foundation of a "Magrath clinical scholarship," to be given for proficiency in reports of bedside cases open to fourth-year medical students.

AT an extraordinary meeting of the senate of the University of London, held on July 17, resolutions were adopted, as we learn from *Nature*, approving of the Foundling Hospital site in Bloomsbury for the proposed new headquarters for the university, in accordance with the recommendations contained in a report of the Special Sites Committee, over which Sir Philip Magnus, M.P., presides. Representations are to be made to the government with the view of obtaining support for the scheme, and the Drapers' Company are to be asked whether they consider the site suitable for the proposed Senate House which they have offered to provide at an estimated cost of £60,000. Lord Haldane is also to be asked to use his influence so that offers of financial support already made to him may be available for the Foundling Hospital site. A motion to refer back the report for further consideration was negatived by a small majority.

MR. H. G. HARTMANN, Ph.D., of Columbia University, has been appointed instructor in philosophy at the University of Cincinnati.

GEORGE WEATHERWORTH STRATTON, B.A. (Colorado), Ph.D. (Ohio State, '12), has been appointed assistant professor in the department of chemistry of the University of Kansas.

DR. OTTO PORSCH has been promoted to be associate professor of botany and director of the botanical garden of the University of Czernowitz.

DISCUSSION AND CORRESPONDENCE

ZOOLOGICAL NOMENCLATURE

MANY zoologists have long been exasperated by the changes of familiar names which result from a blind and inflexible following of the law of priority. The conditions, in fact, are so bad that it is a frequent remark that the only fixed names are the common ones. At the Graz Zoological Congress there was an attempt to have the rules modified and to introduce a little equity and common sense into the nomenclatorial laws, but, although the movement was backed by a majority of those present, it was burked in the nomenclatorial commission.

Recently a number of Austrians (among them the well-known names of Hatschek, Steindacher, Grobben, Sturany, Graf Attems, Przibram, etc.) have formulated three proposed modifications of the laws and rules to which they wish all who favor them to subscribe. In the same line is the recent action of the German Zoological Society, which at the Halle meeting adopted three articles which are to be presented at the next (Monaco) meeting of the Zoological Congress to be held in March, 1913. The circulars of both organizations are summarized here. The undersigned will supply copies of the original circulars to all asking for them as long as the supply lasts.

The first section of the Austrian circular modifies article 25 of the International Code and provides that no work which is not binomial in character shall be considered in the nomenclature of genera and species. The second provides that when a species has once been removed from a genus it shall not be considered as the type of the genus in any later revision. This will avoid the most flagrant cause of generic changes and its adoption will allow the retention of the great majority of the familiar names.

The third section is for the government of the Commission on Nomenclature. It provides that all propositions for alterations of or additions to the Rules of Nomenclature which have received an absolute majority of the full membership of the Commission on Nomenclature (*i. e.*, 8 votes) and of the votes of those members who are present at the voting on the proposition at the meeting of the Congress, shall be submitted to the plenum of the Congress for vote.

This last is of great importance since the existing rule (*adopted by the Commission and not by the Congress*) demands the unanimous consent of the Commission before any proposition can be submitted to the Congress; thus allowing a single member of the Commission to overrule the great majority of the zoologists of the world, a contingency which, in the light of some recent occurrences, is not beyond the realms of imagination.

All who are in favor of these modifications are earnestly requested to sign a statement to the effect that they endorse the three propositions of the Committee signed by O. Abel and others, and to send the same to Professor F. Poche, Wien, I, Graben 17, Austria.

The German Zoological Society also adopted three propositions, as follows:

I. Following the example of the botanists, lists of generic names are to be prepared which are to be removed from any action of the law of priority, are never to be changed nor transferred to other genera. These lists are to be increased by special commissions. Prominent among these are the names which were in common use before 1900 and which are employed in instruction. Among these may be cited the following as examples:

MAMMALS

Anthropopithecus, chimpanzee (not *Simia*, orang).
Cercolabes (not *Coendu*).
Caelogenys (not *Agouti*).
Cynocephalus (not *Chaeropithecus*).
Dicotyles (not *Tayassus*).
Echidna (not *Tachyglossus*).
Galeopithecus (not *Cynocephalus*).
Lemur (not *Procebus*).
Manatus, manatee (not *Trichechus*, walrus).

BIRDS

Cypselus (not *Apus*).

REPTILES

Coluber (not *Elaphe*).
Trionyx (not *Amyda*).
Tropidonotus (not *Natrix*).
Vipera (not *Coluber*).

FISHES

Amia (not *Amiatus*).
Bdellostoma (not *Heptatrema*).
Conger (not *Leptocephalus*).

TUNICATA

Cyclosalpa (not *Holothuria*).
Salpa (not *Dagysa*).

INSECTA

Anthophora (not *Podalirus*).
Periplaneta (not *Stylopyga*).

CRUSTACEA

Apus (not *Triops*).
Astacus (not *Potamobia*).
Daphnia (not *Daphne*).
Homarus (not *Astacus*).

HIRUDINEI

Clepsine (not *Glossiphonia*).

MOLLUSCA

Octopus (not *Polypus*).
Unio (not *Lymnium*).

BRACHIOPODA

Terebratula (not *Liothyrina*).

ECHINODERMA

Holothuria (not *Bohadschia*).
Moira (not *Echinocardium*).
Colochirus (not *Actinia*).
Schizaster (not *Spatangus*).
Spatangus (not *Prospatangus.*)
Strongylocentrotus (not *Echinus*).

PROCHORDATA

Phoronis (not *Actinotrocha*).

CNIDARIA

Actinia (not *Priapus*).
Physalia (not *Holothuria*).

II. The transfer of generic or specific names from one genus or species to another shall not be allowed, when this will lead to lasting confusion or error.

III. Certain works are not to be considered in the determination of questions of priority. Among these are:

P. H. G. Moehring: "Geschlechten der Vogeln, Avium genera. Übersetzt von Nozemann." 1758.
Gistel: "Naturgeschichte des Tierreichs." 1848.
Meigen: "Nouvelle classification des mouches à deux ailes (Diptera)." 1800.
Frisch: "Das Natur-System der vierfüssigen Tiere." 1775.

Brisson: "Regnum animale in Classes IX distrib." 1762.
Brunnich: "Zoologiae Fundamenta praelectionibus academicis accommodata." 1772.
Gronovius: "Zoophylacii Gronoviana Fasciculus I." 1763.
Gronovius: "Zoophylacium Gronovianum," etc. 1781.
Geoffrroy: "Histoire abregée des Insectes, etc." 1762.
"Museum Calonnianum." 1797.
Okén: "Lehrbuch der Naturgeschichte." 1816.

This list will be enlarged by the commission.

IV. Also, in determining matters of priority, certain other publications shall be ignored, among them articles in encyclopedias, popular works of travel, journals of hunting and fishing, catalogues, garden journals, agricultural periodicals, political and local newspapers and other non-scientific journals which are without influence in systematic science.

Those who are willing to subscribe to these additions and emendations of the nomenclatorial laws are earnestly requested to sign and send to Professor Dr. A. Brauer, Zoologisches Museum, Invalidenstrasse, Berlin, Germany, a postal card to the effect "I am in sympathy with the propositions of the German Zoological Society to restrict the law of priority and authorize my name to be appended to them."

It is hardly necessary to add anything to the matters referred to above. A single glance at the list of generic names which it is proposed to have removed from the rules will convince any one that the changes otherwise necessary would result in endless confusion without a single gain to science. The other proposals also will appeal to all who are not firmly wedded to an inflexible law with all the deplorable results that must follow. It is only by having many names appended to the proposals that the changes can be carried through the next congress. It is to be regretted that the time selected for the Monaco meeting is such that most Americans will be prevented from attending, but this has seemed necessary from the matter of climate and the times of the European vacations.

J. S. KINGSLEY

DOME THEORIES AS APPLIED TO GULF COAST GEOLOGY

TO THE EDITOR OF SCIENCE: In a recent number of SCIENCE (June 21) is found a communication by Captain A. F. Lucas in which he states without any qualifications that the undersigned "claims the entire credit for the discovery and promulgation of 'the dome theory' of the accumulation of oil in the Gulf Coastal Plain." The statements are found so "misleading" that he feels it his duty to correct them. This he endeavors to do by quoting the article in full and following the same by quotations from those familiar with oil development along this coast.

The misinterpretations the Captain has put upon my article seem to have their origin in our different conceptions of what is implied by a "dome theory." That various theories at various times, each with some excellent and some weak points, have been suggested to account for the dome structures of our coast we know full well. But that there is an acknowledged one styled "the dome theory" is news to the undersigned. That this writer does claim the credit for the discovery and promulgation of "a dome theory" he will have to admit. Others will have to make similar admissions. Even the Captain mentions entering Texas with a "nascent dome theory" in his mind. Possibly this one after successful birth has grown into "the dome theory." However, judging from the tenor of the Captain's article, including quotations, it seems that the phrase, "the dome theory," has often been used to imply simply short anticlinal or quaquavasal structures with local oil concentrations. If such be the general acceptation of the phrase then the writer must frankly admit that the "credit for the discovery and promulgation of" the dome theory of the accumulation of oil in the Gulf coastal plain is not his. The tendency of hydrocarbons to accumulate in anticlines,

long or short, was a well-known fact long before the development of the coastal oil fields. That the coastal plain contained structural irregularities—as at Sulphur—was early discussed by Hilgard, as all students of Louisiana geology must admit. The idea was temporarily discounted by some subsequent writers who saw no signs of structural complications at the surface. The drill has settled all this. What the nature or origin of such irregularities really was as hinted at by Captain Lucas in the expression "nascent dome theory" we have little from his pen to indicate. Some said afterwards that his ideas were thus and so; even the Captain seems now to prefer to quote from these sources rather than from contemporary statements of his own. However, to Captain Lucas belongs the credit of not only believing that something worth while was under Spindletop (as Higgins did ten years before) but of influencing capital to go in with him in making a thorough test (for sulphur?).

In studying the geology of the coastal plain for some ten or a dozen years the writer has had occasion not only to learn what others have thought as to the origin of those remarkable coastal structures, but to make observations and collections in the field for himself. He too has proposed a "nascent" or at least an embryonic dome theory (not claiming it as "the dome theory") whereby the "movement upwards of huge masses of rock salt," etc., must produce structures, not only of the well-known inverted saucer-shape at top, but of upturned, pinched out, slickensided beds along their flanks. All these when there is an alternation of pervious and impervious beds may aid in oil concentration. Lateral or flank oil, in contradistinction to crest oil as at Beaumont, is well known at Anse-la-Butte, Vinton and now at Pine Prairie and doubtless occurs in paying quantities at Belle Isle, Sulphur and many other domes. The insistence by the writer on the proper locations for oil in the "flank" condition is what the director of the Myles Mineral Co. had in mind when he wrote:

> I consider this a most remarkable vindication of a theory originated by you and we attribute a large measure of success thus far to your advice.

With all the above facts in mind the undersigned still sees no harm in referring to the workings of his own dome theory, provided he labels it as such—as he did. Nor can he see how such references can in any way detract from the credit due Captain Lucas for his views on dome structure—whatever they were.

As a parting shot the Captain calls attention to my incompetency in "locating wells" because the Producers well at Pine Prairie "failed to produce." Allow me to state I had no hand in its location. It is too far away from the flanks of the dome for any economic results. So far, the locations I have approved have yielded oil or gas or both in fair quantities. Can others say more?

G. D. Harris

Pine Prairie, La.,
June 29, 1912

UNIVERSITY CONTROL

LETTERS FROM CORNELL UNIVERSITY

It is certainly curious, to say the least, that in a democratic country we should have developed what is apparently a monarchical system of university government, whereas in monarchical countries they have democratic systems of university control. However, I doubt whether the government of American universities is really as monarchical as it sounds, or as the organization would suggest. Of course, there are good systems of government and bad systems of government as such, but the success of any system depends in the end largely on the personality of the members of the board and of the president. It is possible to work out a thoroughly democratic system even under the monarchical form that we have established in this country. I am afraid that a discussion of this question is likely to be largely academic, for I do not see any reason for thinking that we shall be able to make any radical departures in the general philosophy of the administration of our institutions. In the case of state institutions particularly, the representatives of the people

must in some way have charge of the institution; and this of itself throws the organization of the governing board into one of three or four alternatives. I am afraid myself that the plan that you have proposed would in the end prove to be too complicated, although it seems of itself to be simple. The general tendency in our busy American life is that persons will delegate their authority and their responsibilities to persons who are willing and in position to take them. My own feeling is that we must accept the general block outline of the American system, and then make changes here and there, but more particularly try to develop a better spirit of cooperation and correlation between all parts of the institution. For myself, I think that the developing of this new spirit is really the keynote to the whole situation. I think this can be developed by free public discussions of all the questions involved, just such as you yourself are making. I should not myself be so much interested in any scheme as I would to put before the college and university people of the country a dignified series of discussions, running over a series of years, that would uncover the weak spots and the inefficient and domineering practises that are likely to result in the American systems. I think that we should soon find ourselves able to distinguish four or five cardinal principles around which we could group all the varying opinions and that we could make very great progress toward the development of a greater cooperative responsibility on the part of all persons who are parts of the institutions.

(1) I am afraid that this is not feasible. I doubt whether the professors would pay dues. As you yourself point out, there are special difficulties in the case of state institutions. (2) Not feasible. The president has to travel and entertain in a way that the professor does not. He can't do this unless he has a larger salary directly or indirectly. (3) Sound. (4) Sound, except that it makes no provision for a department which has run down and which really needs reorganizing. Of course the members of the department are outvoted two to one, but I am not certain how it would work. While the principle of equal salaries is good, I don't know whether the average university would not be handicapped under it. (5) Sound. To my mind the worst feature about the university situation is that the president is the only man who explains the views of the faculties to the trustees and *vice versa*. No man can do that fairly. There ought to be at least two other members of the faculty on the board of trustees. This would be an easy reform to put through and would eliminate many, though of course not all, of the present difficulties.

While I agree with the main principles of your proposition for university control, I could not agree with all its details. I am heartily in accord with your proposition to limit the activities of the American university president, particularly with reference to the appointments of professors and to their tenure of office. At the same time it seems to me that there is need of a more centralized organization than your plan proposes. There surely seems to be need of a competent executive, and in private endowed institutions there has apparently been justification for the view that there is need of an executive who can also secure funds for the university. It is my feeling that the activities of the American university president should be distinctly curtailed, and that he should receive supervision on the faculty side as he has on the trustee side, but I am not of the opinion that the office should be abolished. I believe the evils that have crept into the system can be amply checked by very light modification in existing conditions.

In university control the wisdom of having both a chancellor and president is questionable. Although separate duties and qualifications may be required of each, there would doubtless arise occasion where there would be an overlapping of function, giving rise to divided authority and divided responsibility. This usually means less harmony and less efficiency. The university executive should pos-

sess high educational and business standards. Not all of the university's business is done through the treasurer's office. In this modern age why should not education and business go hand in hand? Some universities have been able to demonstrate that it can be done. If there are peculiar and exacting qualifications demanded of the executive, it is only fair that there should be greater compensation. In some universities a certain number of the alumni are elected to the board of trustees by their fellow alumni. Why should not the faculty elect a certain number of their members to the board? Is there any other group in the university which has a greater interest in its success and welfare? A board of trustees composed of certain members elected by the trustees themselves, others elected by the faculty, and still others by the alumni, would be a truly representative body. (If a state university and the trustees are appointed by the state, the election of trustees by the trustees themselves would probably not occur.) Alumni, faculty, trustees and president, all would participate in the administration of the university. In this way all of the constituent parts would come into closer relation with each other and if unity is strength in the republic it should be so in the university. Sections (3) and (4) of your circular seem to me very desirable.

I agree that the system of control current in American universities calls loudly for readjustment. The powers vested in the presidency should be more narrowly limited than at present, especially as regards appointment, salaries and the departmental distribution of funds. The authority of the officers of instruction should be augmented in matters directly or indirectly touching the conduct of the several departments. The trustees should be responsible to the whole university. (1) The type of "corporation" proposed might work; I am uncertain. I suspect that its most difficult occupation would be the equitable distribution of income from university properties. (2) It is absurd to declare that the president's "salary should not be larger, his position more dignified or his powers greater than those of the professor." The important point is, surely, that the authority be properly delegated, and the dignity and salary earned. (3), (4) and (5). I find myself in substantial agreement; though the prescriptions are, in part, Utopian.

The present system could no doubt be much improved. The great trouble seems to be that investigators do not give time or interest enough to such matters. They will always be too deeply buried in the laboratories and this renders the situation difficult to improve.

The plan you propose would certainly be vastly superior to the present plan. As to its details I am not competent to judge.

The form of organization outlined by you seems to me to be an ideal one and I would be prepared to endorse every paragraph as you present it.

I have read your tentative plan of university control to be reached as the result of gradual evolution with much interest. It seems to me perfectly feasible and I am certainly in hearty accord with its main purpose, viz., to do away with the despotism of the president and of the heads of departments. The present system of control in our universities is certainly not the best that could be devised and is unworthy of a democratic country like ours. Your plan has much in it that commends itself to me from my experiences as a university professor and I hope that you may succeed in bringing about some reform of the present system at least. Intelligent discussion of the subject can certainly do no harm and it may direct attention to the matter and thus ultimately do some good.

While I may not have very definite views on the points you raise, still a few of them have of course been considered by all academic men. (1) The body of trustees should be large enough to prevent perpetuation of whims and irregularities that may creep in in times of special pressure. Footnote 2 is a

good safeguard. (2) As most of my own preparation was in a German university, I heartily endorse this view. It is not a promotion when an able and active professor is asked to assume the executive duties of a president. It frequently stifles the man and does not magnify the office. (3) These groups should not have enough autonomy to allow one group to pool its interests against those of another. It can be remedied easily by enlarging the relations you outline in (5). There is danger of lessening the community of interests with other departments when one or two groups grow in numbers and importance. Other groups may be forced to the wall. Footnotes 8 and 9 meet my hearty approval. An instructor should not feel that it is simply a matter of routine to await promotion, but rather that it lies largely with himself whether he advances.

In general, taking your plan for granted, and without going behind it at any point, I should say: It is too bureaucratic; it substitutes one mode of high organization for another. But I do not believe in organization at all; or rather, given the minimum with which an institution can exist, I should prefer to let the organizations within the institution grow at haphazard. My ideal, still in terms of your plan, would be: (1) A faculty with an annually changing chairman; (2) a board of trustees; (3) an annually changing faculty committee of say ten men, to meet with a similar trustee committee; and (4) paid permanent extra-faculty officials; registrar, treasurer, secretaries of faculty, whatever they may be called and as many as the size of the university may demand. Everything else in the way of predetermined or foreseen organization—directors, deans, school-units, appointing boards, etc.—I regard as cumber. And, publicity being presupposed, I should let every institution follow its own natural line of development. If I turn now to your proposal in detail, I should have the following criticisms; I can only state them dogmatically: (1) I think that the state universities are not comparable to the endowed universities; I think it will be a long time before they can possibly be universities; and I think that they are tending away from that ideal towards the development of vocational and professional schools. Your plan contemplates the perpetuation of the large universities, *i. e.*, of the present college-university mixture. I believe that college and university should be personally and spatially separate. I do not think that one can start with the corporation; and it is not necessary to do so, as we have boards already. I mistrust alumni, in anything like equal numbers with faculty; here, I suppose, everything depends on the age of the university, the character of its student body, etc.; I can only speak from experience. I also mistrust the "community," if that means the immediate surroundings of the university. (2) All right as an intermediate measure; but I believe in annual rotation, and I think it would suffice. (3) These are natural units, and need no organization. To make them formal would have its positive disadvantages (inbreeding of ideas, cliquism) and would also do injury to the smaller divisions, which would have to be affiliated to some stronger unit. Psychology, *e. g.*, would have to go to philosophy or education or biology. If a formal unit is required at all, I prefer a unit in which men of very varied interests are bound to meet together in behalf of the university. It would, I think, be a good thing for me to have to dine once a month with an architect, engineer, historian, agriculturalist, biologist, lawyer. These units, if necessary or advisable, might be determined by lot. (4) Far too bureaucratic. Let all business be wholly public, but let representation, appointment, etc., be settled in detail locally by the separate institutions. Do not try to measure "amount of work"; let the candidate understand the present duties of the chair, and then, if he is elected, give him a free hand. (5) Still too bureaucratic. Let every proposed measure that finds a specified number of seconders be voted on always by the whole faculty by postcard; if a meeting is wanted, let it be demanded of the permanent secretary by a specified proportion of the

whole. If the mover is keen, he can print and distribute his arguments. As the first step in advance, I should accept your suggestion of a regular joint-committee of faculty and trustees. As the second step, I should abolish all salaries of deans and directors. I should put extra-faculty permanent clerks in training. Meanwhile, if a faculty-member has to be dean or director, I should excuse him in so far from university work, but should allow him only the professorial salary. I should aim throughout at the realization, by every member of the faculty in the widest sense, that he must be both responsible and loyal to the university, *i. e.*, to his fellow faculty-members and to the students. I should hope that in time the idea of the "university" might include the trustees; though it will, I fear, be long before the professor ceases to regard the trustee as his natural enemy, and the trustee to regard the professor as a fool to be kept harmless. I should hope, also, that in time the whole university, faculty and trustees, might be capable of combined action on definite educational lines; even if this took a generation, I should not mind. I dislike difference of title; and I should hope that in time there would be no difference, save of permanency of appointment. We should then have, perhaps, professors elect and professors designate, and that is all; perhaps we might even abolish titles altogether. I do not believe in specially high salaries within the university. A great deal of this is, under present conditions, utopian; I do not think that I could myself live up to my ideals; brutalities and jealousies warp one even against one's will. But I think that with some suffering and many relapses for a generation, the utopia might be approximated.

Your general summary of university evolution from comparatively small colleges to their present dimensions and complex interrelations I have seen with my own eyes. I think that every one who has helped in the evolution of the American university to the present stage expected a simpler organism than actually came from their efforts; and perhaps sometimes we feel hardly willing to accept our own creation. As you say, there was comparative order and simplicity in the smaller institution; but there is now complexity, and reversing the order of the creation described in Genesis, there is considerable chaos as a result of our creative efforts. But we are not through yet, and in some such plan of representative government as you have outlined, I believe a glorious youth and maturity are before the American university. To answer the questions in order: (1) This is practically the system I have lived under. (2) This seems to me an unnecessary complication. In No. 5 there would naturally be a chairman chosen for the group or groups meeting together. (3) This is entirely practicable and works well. (4) This is the kernel of the whole matter, and by contrast brings out the real difficulty in American universities. We are too much "boss ruled," and have too little of the true principles of self government; and self government is at the root of all permanency in a free commonwealth whether political or educational. The method you propose, in part, I have lived under and know that it is practicable. I have also lived under a system in which over-lords were appointed by a higher over-lord to rule over each province—in a word "boss rule"; and it destroys the fine spirit of a university as it does that of the state and the nation in political matters. I think that in no situation in life is leadership more desired and appreciated than in a university; but leaders, to be followed, must be chosen by, not imposed upon, a faculty group. (5) This is a logical sequence to (4).

LETTERS FROM THE UNIVERSITY OF CHICAGO

I FEEL very little sympathy for the type of organization which you recommend. I spent seven years in an institution which had a democratic organization on its faculty, and I am persuaded that that organization is defective in more ways than the organization at such an institution as Harvard or Chicago. It is defective first, because of the difficulty which always arises when one tries to convert a body of men to new and progressive policies. It is very much easier to get the ear of one

intelligent administrator, and carry through a policy of reform, than it is to get the sympathy of a number of heads of departments. In the second place, I do not believe that heads of departments are as efficient when it comes to deciding general policies for an institution as some detached executive officer who can look beyond the interests of each of the departments. The experience of such institutions as Yale and Cornell seems to me to be conclusive against the democratic organization. They found exactly the same difficulty in Cornell and voluntarily voted away the authority which they at one time held. I am not optimistic, either, about the ability of academic men to organize their own government. I think that the specialist in science or literature prefers to have somebody develop the methods of scientific organization and relieve him of the necessity of considering these matters. In other words, an administrative officer equipped with methods of investigating his own problems seems to me to be a very proper solution of the difficulty in which we now find ourselves.

As regards your first proposition, I may say that it seems to me at least harmless. If it resulted in attaching to the university a larger group of serious-minded and intelligent persons than is at present the case, I should think it in so far useful. I am not clear that the chancellor, for whom you make provision, would be a particularly useful official, unless he were content to remain largely ornamental, as is often the case in the English universities. His usefulness in that case would be of a sort not likely to come into conflict with the policies adopted by those more directly responsible for the conduct of affairs. Your proposition under the second heading to elect a president from the members of the faculty and to give him no larger powers and no larger salary than is received by other members of the faculty strikes me as somewhat impracticable. I can not imagine any man whose intellectual capacities and attainments would justify his presence on a faculty of a first rate modern university, who would be willing to make the sacrifice of time and strength necessary to assume administrative control under such conditions. Possibly members of the department of education might find in such a function a professionally advantageous occupation, but for other members of the faculty it could only be a time-consuming and thankless job from which the abler men would unquestionably shrink, and presumably would succeed in avoiding. The idea that the faculty should have some voice in the selection of a president I heartily approve, but our own generation seems not to be in sight of such a distribution of administrative detail as would justify any able scholar in turning his attention to this phase of university work were he not rewarded by some increase in his salary or his powers. The application of your suggestion in point three meets my hearty approval. Experience has abundantly shown that we need a smaller unit of organization with very definitely specified responsibilities if we are to secure effective and intelligent participation by members of the faculty in university government. The fly in this particular ointment comes at the point where the interests of any particular group may run counter to those of some other similar group. You provide in your fourth paragraph that such a group shall have as complete autonomy as is consistent with the welfare of the university as a whole. This means that some one has got to decide whether the welfare of the university is or is not in any given case invaded by the action of one or another department. You will then have to fall back on a larger body, or on some administrative official who may prove to be an unjust judge. I do not regard this difficulty as insuperable, but I could relate instance after instance in which it has proved practically very serious. I approve also very heartily the spirit of your suggestion in paragraph four that nominations to professorships shall be subject to a competent advisory board. You supply a rather undue amount of machinery for this purpose, but some check of the kind represented by a competent board is certainly highly desirable. I also approve the sugges-

tion whereby each unit should have control over the expenditure of its own funds. I feel that at the present time a large part of the most irritating difficulties which members of the university faculty encounter concerns the necessity they are under of making a purely personal appeal to the president and trustees instead of being able to distribute as they may think wise a specified portion of the university funds, and instead of being permitted to augment those funds as they may be able. Your final sentence in paragraph five is a gem. "There should be as much flexibility and as complete anarchy throughout the university as is consistent with unity and order." In other words, there should be a chaste and orderly disorder. This also I sympathize with, though the actuaries give me no reason to hope that I shall survive to see it in operation. In general I feel very strongly that the present situation has many very undesirable features attaching to it, of which not the least is that the president tends too largely to become a purely fiscal officer whose interests and outlook are almost wholly financial in character. No doubt this aspect of the great modern university must be cared for, but I think it is a great misfortune that the more purely educational and scientific interests can not be placed upon a more autonomous basis whereby for any given year at least, or indeed for any period of five years, the authorities in charge of a division of the work of the university may know to a nicety the minimum sum at their disposal, and may be permitted to expend it as it seems to them best. The subserviency to the president and trustees which the present system breeds is both morally and educationally wasteful in my judgment, and that it produces a destruction of esprit de corps and the higher forms of loyalty is too obvious to be debated.

In a general way your scheme of university organization seems to me to be an admirable one, although there are a number of difficulties which the plan has in my mind. In the first place, I think the plan of operation would work out very much better in an organization having a considerable degree of homogeneity than in a university having a very large number of academic and professional departments with little or nothing in common, and frequently with sharply conflicting interests. Might it not happen, for example, in a school of the latter sort, that the professional interests, which are usually rather rabid in their demands on account of their practical value, would completely outweigh those of pure science and academic work? It seems to me that we might expect exactly this to happen when the law, engineering and medical faculties are brought into contact with the pure science groups, and it is especially injurious to the interests of the academic and pure science groups that the applied schools have a larger number of faculty members than the academic and strictly scientific bodies. If all productive endowment were divided up so that each general group in the university would have its own funds, and was to all intents and purposes an independent school financially, the difficulty would not be so great, but if all the funds were contained in one general endowment I think there would be serious difficulties which would prove most injurious to the things most worth while in our university. This is the most serious phase. Secondly, with regard to the constitution of the corporation. It seems to me that the admission of any very considerable body of alumni and members of the community where there is sufficient homogeneity of interests might be all right. On the other hand, would there not be the danger of getting in those who gain their popularity from their fellows through athletic contests and social position, rather than through real worth or capacity to take part in the deliberations of the corporation? It might also lead to a situation in which the faculty would be compelled to take cognizance of temporary, erratic, social beliefs. Still, leaving out these difficulties which are not insurmountable, the plan of organization proposed under (1) is probably better than that in vogue in our institution at the present time. The various provisions provided for under (2) seem to me to be rather desirable,

and need, I think, no comments. I am not sure, however, that your suggestion of an annual election of a director is a wise one, because the complexities which exist in an institution of this kind, I imagine that it would take the larger part of the year for a man to learn the task before him. A period of five or ten years might be highly desirable, and I would also suggest that some sort of provision be made for referendum and recall when the administrative officer is no longer satisfactory or when his policies become unbearable to the rest of the professorial body. I think opinion would differ very much with regard to number (3), especially with regard to the size of the group which you suggest as a psychological constant. In principle, however, these aspects of university organization seem to me to be admirably conceived of and very much in advance of the present arrangement. In (4) and (5) I think I have nothing to comment upon. I am in harmony with the principles expressed therein, with the single exception, under (4), that the division should have financial as well as educational autonomy, which would depend upon the type of financial organization adopted in the institution. I judge that your plan would be to have a series of separate endowments for the departments. I would like very much to see this sort of thing put into operation and see how it works out.

It must be clear to every one that in the small college of earlier days the president's ideas on college policy and the policy of his college were almost or quite identical. Furthermore, the college seems to be about as conservative an institution as we have in this democratic country. This early college president was usually conversant with practically all the subjects taught in his college. The number of subjects was limited and confined almost entirely to the classics in which the president had received his own training. Since that time the sciences and humanities have been differentiated into so many subjects that no college president pretends to know much about many of the fields of work covered in the college curriculum. It must be equally clear that in order to represent the interests of all these various departments the opinions of all must be considered. The field is certainly too broad and too specialized to enable any one man to govern all of them adequately and justly. If the faculties were incompetent that of itself would be justification for a continuation of the earlier policy, but that claim can not be upheld. Democratic government of a university would certainly make a place for utilization of the intelligence and sympathetic cooperation of the large number of men who are really interested in university administrative affairs. To speak of your propositions by number I wish to say: First, that responsibility placed upon a larger number of men is certainly desirable and your plan for securing it appeals to me. Secondly, the president certainly should be selected because of his "expert knowledge of education and university administration." I do not quite see how it would be possible to have a president and a chancellor both operating to the best advantage to the university without having their fields overlap considerably. For example, the public is quite as much interested in the educational aspects of the university as in its business aspects and in its connection with public affairs. Thirdly, the departmental unit seems best to me. Fourth, in a great many of the universities at the present time appointments to major positions are made only upon nominations which are the result of careful consideration by all the faculty of the department in question. It seems desirable that that plan should be made general. Fifth, I like the proposition of number five if we assume that the senate or the general faculty of the university has prepared a full and definitely stated constitution outlining the policies—administrative, financial and educational—of the university as a whole. This policy should be general but definite and should leave autonomy to the departments on all questions that are at all likely to concern departments only. But general policies should certainly be stated in a general constitution that would

outline the functions of the university as a whole.

Your suggestion (1) seems to me a good one, in that it would restrict the powers of the board of trustees to those affairs of the university which are non-educational and at the same time dignify leadership in that very important department of university administration. I am not sure that I should like to see a university faculty, as a whole, take part in the election of the president, but it seems to me that the faculty should have influential representation by a committee composed of its most influential men, possibly elected by the faculty as a whole, on the appointing body. The division of the interior administration of a university into parts seems to me essential to economy, and I think that the association of a committee or member of the board of trustees with each of the partial faculties would tend to a better understanding between those interested in the educational and the other work of administration. The question of appointments and promotions seems to be a difficult one. Your plan seems to me well suited to insure good new appointments but I am not so sure about appointments which are also promotions. In either case it seems to me that the department concerned should be well represented by an elected committee, and the final appointive power should be vested in a number of men rather than a single one. I do not believe that any two men holding the same kind of position do the same amount of work, and think that the salary should be adjusted accordingly, possibly between limits specified for the particular office in question. Many good men are lost and others lose ambition when a salary schedule is rigid. I like the idea of a university senate working in coordination with the trustees, and the ideas expressed in your section (5) for bringing the trustees and faculty into closer touch with each other.

The plan you propose seems to me to be excellent for an institution that is given over largely to teaching. In smaller colleges the various members of the faculty see each other frequently and each keeps in touch with the work of the institution. Your plan, as I understand it, contemplates similar intimacy among groups in the larger organization. While I believe that your plan would work well and be a great improvement in an institution given over to teaching and in which the proper care of the students and of their problems was of first importance, it seems to me that a university that attempts to make research its highest aim, would have difficulty in carrying out your plan. At present, with the autocratic form of government which we have here, the research men complain bitterly of the amount of time required for committee work, faculty meetings, etc. Your plan would increase the demands on them in this respect. Since my main interest is in the teaching side and in research in education, I would like to see your plan tried, but I feel certain that the men interested in research in science will object to it for the reason stated.

(1) This paragraph seems to me good, though the plan referred to in the footnote of deriving income from fees from members of the corporation is bad. Either the income so derived would be small or else the financial burden on the trustees would be such as to encourage the selection of trustees on the basis of their financial rating. (2) The president should be elected by the faculty, but the office of president, like that of professor, should be a permanent one for the sake of continuity and stability of administrative policy and the precise localization of responsibility. The salary should be adequate to get the best available administrator regardless of salaries paid to other officers. Much more important than the president's salary is the control of the university budget, which should be taken out of the president's control and lodged with the faculties or senate. (3) Good. (4) This I approve, save that I think it unnecessary that the professors' salaries should be uniform. Footnote 8 seems to me especially sound and important. (5) This commends itself to me as good. In general, I

think the plan proposed or slight modification of it is both good and practicable.

In general, the proposed scheme for university control appeals to me as excellent. I particularly approve of the statement to the effect that the fundamental difficulty in the situation lies in the fact that the president is responsible only to the trustees, while the professor is responsible both to the trustees and to the president. We are having a little experience in connection with note 6, having two practically independent institutions for research, closely affiliated with the university, and so far it has been a very satisfactory arrangement, at least from the side of the independent institution. What the university thinks of it, I can not say.

Your tentative proposal regarding the organization of our larger universities seems to me to be a lead in the right direction in that it aims to curtail the autocratic power of the president and to place the whole organization on a more democratic basis. I am not so sure, however, that the proposed changes would work out in practise, for even in some of our most democratic institutions there exists a tendency towards centralization of control. As an example of a university controlled by a corporation composed of professors, alumni and interested members of the community, one might cite the Marine Biological Laboratory at Woods Hole, where the actual administration is largely in the hands of the director. Ordinary members of the corporation have little or no voice in directing the policies or business of the institution. Although an annual meeting of the corporation might seem to furnish an opportunity for the ordinary member to exercise his franchise, this is really not the case, as all matters, including election of officers, are settled before the meeting. Thus may our most democratic bodies revert to oligarchy. It must be admitted, however, that we have in the Marine Biological Laboratory a close approximation to the ideal university conditions. In my opinion one of the most serious objections to the present autocratic type of university president lies in the fact that he may be, and sometimes is, a man of little force, readily influenced by certain of the more dominant members of the faculty, who are able to mould his policies often to their own personal ends. Thus arises favoritism, financial and otherwise, toward departments, which happen to have at their head men often of low scholastic attainments but highly endowed with the qualities of political leadership or merely with a pleasing and persuasive personality. The department headed by a man or men of scholarly tendencies and little or no time or inclination to curry favor, may, and often does, fail to receive a fair amount of encouragement or support.

There is no question of the need of some reorganization. The fact of the establishment of research institutes independent of the universities shows, I think, that the universities have lost the confidence of those desiring to aid research; and investigation is the *sine qua non* of university existence. For this our organization appears to me to be at fault, the main trouble being that the universities are actually not in the control of their faculties. The plan you suggest would return that control and is, therefore, good. Your general plan strikes me as very similar, with some additions, to that of the Marine Biological Laboratory at Woods Hole. This has worked extremely well in that institution. While the criticism is sometimes made that scientific men and scholars can not be trusted to manage funds, the Marine Laboratory entirely disproves such a notion. No institution in the country has made so little accomplish so much as the Woods Hole laboratory. I am a little uncertain what the duties of the president would be under your plan. I am inclined to think that the only men who are really competent educators are the scholars, and I fear you will have difficulty in finding any scholar willing to assume the duties of a president unless he have some additional recompense either of salary or power or honor. Certainly the president should be elected by the faculty, or the trustees should elect from

two or three men nominated by the faculty. The organization of departments into autonomous divisions is a good scheme. We have lately adopted unofficially something of this sort here in the form of an advisory committee of all the biological departments. It works very well. This committee recommends to the president on biological affairs of general interest. As regards the organization of a department, I believe it makes little difference whether there is a head chosen by the president or a chairman elected by the department. I have lived under both systems. Each is good with the right kind of men in the department and each is bad with the wrong kind. I should like to see the plan tried.

I thoroughly agree with your general principles, especially with your demand that each department should have as complete autonomy as possible, and that there should be as much flexibility and as complete anarchy throughout the university as is consistent with unity and order. But it seems to me that your specified list of desiderata is somewhat too detailed, considering the great diversity of American universities. In particular I think that different rules ought to be laid down for the college and the university proper. I also doubt whether your method of appointing professors is the best. I think it dangerous to give any body of professors, except those in the special department concerned, a deciding influence upon the appointment.

The plan suggested seems to me to be admirable. I wish to emphasize my belief in the desirability of those features of the plan suggested in paragraphs (1) and (2), and in that part of paragraph (4) which deals with the nomination for professorships. The present system of control is, at least in most institutions, highly unsatisfactory and moreover is not really effective.

Of course, if I went through your paper with a fine comb, I could probably find something to criticize, but reading it in a proper spirit I find that it grows on me, and that the oftener I read it the more anxious I become to see it put in force. One criticism that first suggests itself is that there is nothing hard and fast about the plan, but that you offer alternatives wherever possible. This elasticity, however, is one of its good points, for the new method of controlling the university, if there is to be a new method, can not be put in force all at once in a state of perfection, but will have to be more or less experimental. It has seemed to me with the growing power of the president there has been a distinct retrogression in some directions, and that the great American universities of to-day, with their thousands of students, their hundreds of professors, are in some respects behind the small freshwater colleges of a generation ago. The president in many cases seems to look upon the university as his own property to be exploited for his own aggrandizement. He wants to be the "whole thing," and selects his professors, not on account of their fitness or researchability, but for personal reasons, and because they will toady to him. The independent man is made to feel that he is not wanted, and although his tenure of office is theoretically for life, things are made so uncomfortable that he is glad to leave. It has seemed to me that some of the presidents do not want men on the faculty who are bigger than they are, and although here and there a university may become great through having a truly great president the system is bad and should be eliminated.

I have read your article "University Control." It is most timely. I doubt if I can add anything of value to it. The trouble with the university president is often that he has to spread over too much ground and comes to rely upon the busybody who has the president's ear and a bag-full of rumors for his "information" upon which to base promotions. Also, if he takes his job seriously he will periodically "butt in" to the doings of a department of which he has only the most superficial knowledge. The university president should adopt the principle of relying on

the professor and according him full liberty in his department. If suggestions are in order, I might offer the following plan of making appointments and promotions. The department committee to nominate first appointments to assistantships and other low-grade positions. The division (department group) committee to nominate for promotions or first appointments to instructorships. The body of full professors of any faculty to nominate to professorships in that faculty. Professors in all faculties to nominate the president. All elections to be by the trustees or corporation. The president to be elected for a limited term, and subject to "recall" by the faculty. The president to confer with professors, represent them before the trustees, and the university as a whole before the public. The executive agent of the trustees (comptroller), the president, and a prominent alumnus (elected by vote of the alumni or their representatives) to constitute a "board of estimate." Such a committee would unite the needs of scholarship, the good-will of the community and the limitations of the treasury and arrange the delicate adjustment between departmental needs and university income.

I am heartily in favor of some such plan of university administration as you propose. At present in some institutions control rests in the hands of a small group of trustees who happen to have the leisure, or the money, or the energy to take a leading part, but who are not necessarily qualified to understand the real problems of the American university. The trustees appoint the president, the president appoints the deans, the deans recommend departmental appropriations and promotions, and so a personal tinge is given to all the official relations of the regular faculty members. The present situation is purely fortuitous. Until the natural university groups are given complete autonomy, genuine university development and continuity must remain largely a matter of accident. In your plan as stated the principles outlined in sections (3) and (4) seem to me essential. Precise details must naturally be left for experiment.

Upon the whole your plan is quite in accord with my own views, and I believe that there is already a tendency among our universities toward its inauguration in part. I doubt the expediency of the chancellorship, nor do I think such a corporation as you suggest is at all practicable for the state universities, though possibly some plan whereby the elected or appointed state regents might be limited to the control of funds and to an indirect or direct veto of all matters not strictly academic might be feasible. Especially do I think that the presidency should be an elective office of the faculties. At present the highest honors and emoluments are given, not for scholarship and pedagogical excellence, but for executive and administrative ability.

I am in hearty sympathy with the proposed plan for university control. It is quite preposterous that in a republican form of government our institutions of learning should have what is practically an absolute despotism—while the universities of Europe are the most democratic in their form of administration. I doubt, however, if it be possible—without a disastrous revolution—to change the present status.

I have been president and professor in a state university, and in denominational colleges, and have added to this now my fifteen years' experience here. This simply means that I have looked at the problem of "control" from almost every angle. My conviction is that every group connected with a university should do what it is best fitted to do. Theoretically, the trustees are fitted to conserve and increase endowments, and no more. They should have nothing to do with determining educational policies or with selecting instructors. Theoretically, the faculty are fitted to determine educational policies, to select instructors and to distribute the available funds. As I understand it, these are the views you have worked out in the details of your scheme, and so it has my general

sympathy. But my long experience with faculties has led to the belief that they are made up, for the most part, of very impractical men. They seem to me to be childlike in their selfishness and their idealism. I believe that this is largely due to the fact that they have been kept in childish bondage, and this simply means that they will have to be entrusted with large administration gradually. I certainly disapprove of the autocracy of the American university president, since I have ceased to be one. No developed institution needs any such dictator. It is not right for any man to hold such a relation to his intellectual peers. The details of your various propositions may be open to discussion, but their general bearing seems to me to be sound.

SCIENTIFIC BOOKS

Outlines of Applied Optics. By P. G. Nutting, Associate Physicist, Bureau of Standards, Washington, D. C. P. Blakiston's Son & Co. 1912. Pp. 234.

A generation ago text-books on physics, or special sections of physics, came for the most part from those who were connected with the higher educational institutions of the country. They were usually written by men who were teachers besides being physicists, and who instinctively assumed that the reader demanded a consistent presentation of mutual relations rather than of results.

With the development of large and well-equipped laboratories, some of which are wholly independent of educational aims or limitations, a new range of scientific literature is becoming developed, in which specialization of function is not limited to the author, but assumed equally for the reader. The non-technical reader is attracted by a title, and is assured by an introductory glance that the book contains much of value. He is not disappointed, but is perhaps temporarily disturbed by the necessity to shift his customary view-point.

The author of the present volume announces as his keynote the question of securing the best possible results in optical work. He calls attention to the fact that applied optics is practically untaught in any university. This statement is perhaps a little sweeping, but it is applicable to many of the institutions that in America are called universities. He says frankly in his preface, "the book has been prepared for the worker in applied optics rather than the student; for the men in the field designing instruments, measuring color, examining eyes, identifying illuminants, etc., who may find a suggestion of how to obtain better results or ready information on nearly related subjects."

No one would be apt to open a book on optics who has not already some knowledge of the subject, such knowledge as would cause him to recognize the formulas most commonly in use, besides recognizing the application of principles that are thoroughly established. A well chosen summary of some of these principles occupies much of the introductory chapter, including the formulation of laws connected with names of such investigators as Lambert, Bouguer, Fresnel, Kirchhoff, Stefan, Planck and others. Discarding some obvious typographical errors, and the use of a few words which need explanatory introduction for most readers, the chapter is welcome and interesting.

The second chapter is on the theory of image formation, a subject which bristles with difficulties for the student who aspires to master the various aberrations and the means to be applied for their elimination. The satisfactory presentation of such a subject requires much pedagogical skill, apart from knowledge of the mathematics involved. Pedagogically the author has not always kept in mind some of the principles which every successful teacher must habitually and almost automatically apply, if he wishes to assure himself that his auditors or readers are acquiring power rather than accepting underived formulas on trust. Technical terms are used without adequate definition, and various equations are set forth without deduction. Assuming that the intelligent reader has already studied the subject in detail elsewhere, the chapter constitutes a condensed summary; but to assure himself that he understands everything while reading,

he will need to be somewhat industrious and patient. This may be said with full appreciation of the excellent list of references that is added at the close of every chapter. But the non-technical reader, if he becomes impatient because the demands of the student are not fulfilled, becomes reassured when he looks back into the preface; for he has forgotten that "the book has been prepared for the worker in applied optics rather than the student."

The next chapter is on the design and testing of optical systems. This subject likewise is mathematical, and the treatment is open to some pedagogical criticism; but the amount of information, non-mathematical in form, is increasing; and the individuality of the author as a careful and resourceful investigator is becoming more clearly manifest. Prior to the publication of this book he had become well known through his published work in several branches of optics; and for development in his chosen field it would be hard to find a better place than the Bureau of Standards.

From this point on, the successive chapters contain less material requiring skill in the art of presentation, but much that reveals the author's rich experience in the optical laboratory. He is at home in the discussion of optical instruments and the conditions under which they may be used to best advantage, in the methods of measuring refraction, and in the intricacies of physiological optics. In the treatment of colorimetry, illumination, photometry and spectrophotometry, radiometry and spectroradiometry, polarimetric analysis, plate grain and sensitometry, and interferometry, he has evidently worked with great skill and ardor, enjoying the work thoroughly. He has gleaned information from all possible sources, and has recorded in small compass what might well have been greatly expanded. The present volume is indeed apparently tentative. This is indicated in the preface, where the enterprise is referred to as an entering wedge, since the full treatment of applied optics "could be adequately treated only in a number of volumes by a dozen specialists." It is to be hoped that these volumes will appear in due time, but that upon them better editorial care may be applied than is manifested in this initial volume.

W. LEC. STEVENS

LEXINGTON, VA., July 10, 1912

Distribution and Origin of Life in America. By ROBERT FRANCIS SCHARFF. New York, The Macmillan Company. 1912. Pp. xvi + 497, 21 maps.

Students of zoogeography the world over will welcome this book, for the author's masterful treatment of the European fauna[1] leads one to expect that he will bring to it the same wealth of ideas, sound knowledge and good judgment that characterize his previous work. In the opinion of the reviewer this expectation is fulfilled. The data are presented about as exhaustively as is possible in a work of this size, the opinions of different students are summarized in an unbiased way, the generalizations and data are carefully weighed, and the author's conclusions are clearly expressed.

Very little but good can be said of the general method of attack. Dr. Scharff fully realizes that problems of origin and dispersal can not be approached from the standpoint of zoogeographical regions, and no space is given to this subject. He analyzes separately the faunas of different parts of North, Central and South America, and of the Antilles, Bermudas, Galapagos and other American islands, and endeavors to discover the sources and migration routes of the different elements. He goes to some length to show the very small rôle which he believes accidental dispersal plays in the populating of distant lands—a method that has been clearly overestimated since the classic works of Darwin and Wallace —and expresses the conviction that the facts of North American zoogeography can best be interpreted by postulating various land bridges. When such land bridges are apparently called for, the author endeavors to gather evidence for them from botany, geology and paleontology.

Dr. Scharff argues for the existence in pre-Glacial or Glacial times of a North Atlantic land bridge, connecting Scotland, Iceland, Greenland, and Labrador, and a North Pacific

[1] "The History of the European Fauna."

bridge across Behring Strait. Unlike many students, however, he does not think that these are sufficient. He contends that there must have been an early Tertiary trans-Atlantic bridge from southern Europe to a hypothetical "western land" lying just west of the present American continents. This land bridge, according to Dr. Scharff, included the Antilles and parts of Central America, and was, by means of the "western land," first connected with both North and South America, then separated from North America, and subsequently reunited with North America and separated from southern South America. By such an hypothesis one can explain the European elements in southwestern North America and the Chilean region.

The "western land" was, Dr. Scharff believes, part of a great arc "which stretched mainly northward, communicating from time to time with Central America and the Antilles, and also with Mexico and western California, and then eventually bending across to eastern Asia in a great loop and thus joining New Guinea, Australia and New Zealand." This bridge is made to account, among other things, for the evidently continental fauna of the Galapagos Islands, the relationships between the living and extinct faunas of western North America and southern South America, and for the Asiatic elements in these faunas.

As has been intimated, Dr. Scharff believes in a former union of the Antilles with each other and with the trans-Atlantic land bridge and the "western land." He also thinks that the Bermudas and the end of the Florida peninsula (then an island) were also connected with this land mass. He further postulates a direct connection between Chile and New Zealand, but not by way of an Antarctic continent, and is willing to grant slender bridges between southern South America and South Africa and Madagascar. Although he does not dwell upon these southern bridges, he suggests that incentives to migration may have been found in changes in climate due to changes in the direction of ocean currents, so that Simroth's pendulation theory need not be relied upon.

The author's treatment of the Ice Age in North America will undoubtedly come in for a large share of criticism, for his views are quite different from those now almost universally accepted in this country. Very briefly, it may be said that he denies the existence of continental ice-sheets in the Pleistocene, although admitting that this was an age of extensive glaciation, and believes that the climate at that time was temperate and even warmer than at present. The large bodies of water forming the Pleistocene great lakes he attributes to a marine invasion. He does not believe that there was a general southward migration of northern forms in the Pleistocene, or that the southeastern states served as "biotic preserves" during the Ice Age, but thinks that the fauna in the drift area was in part destroyed and in part persisted in favorable localities. He emphatically denies that the evidence is sufficient to warrant the theory that zones of northern animals and plants were spread out beyond the margin of the drift area in a manner comparable to the present distribution in the far north.

The author himself scarcely ventures the hope that his views on the physical conditions during the Ice Age will be readily accepted. A growing number of zoogeographers in this country will, however, be quite willing to agree with him that current geological opinions are permitted to dominate biological thought to a far greater extent than the facts of distribution warrant. We should have more evidence of Pleistocene distribution and not try to erect elaborate theories principally upon geological evidence. It may be pointed out that, granting the ice-sheets, there is still no reason to believe that the margins of these were not covered for miles back with soil and vegetation, as Russel found to be true of the Malaspina glacier, in which case no zonal arrangement would prevail comparable to conditions in the Arctic regions at the present time.

A conviction expressed by Dr. Scharff that will have adherents is that southwestern North America is and has been in the past a very important center of dispersal, as some previous

writers have contended. He believes that many of the forms that now have their center of dispersal in the southeast originally came from the southwest, either directly or possibly by way of the West Indies, and that changes in climate since the early Tertiary have extinguished the primitive forms in the southwest.

It has been possible in this review only to touch upon a few of the main points in the book, but enough has been said to show that many of Dr. Scharff's conclusions will not meet with general acceptance. However, even if they should be entirely overthrown, the general usefulness of the book will not, in the opinion of the reviewer, be impaired, for the summary of data and generalizations can only be of the greatest use and a source of inspiration to students of the American fauna.

ALEXANDER G. RUTHVEN

RECENT ANTARCTIC WORK

National Antarctic Expedition, 1901–1904. Natural History, Vol. VI., Zoology and Botany. London, British Museum. 1912. 4to. Pp. xvi + 81, 8 plates.

With the publication of this volume, the series of reports of this expedition relating to the natural history is brought to a close. The special reports included in it are "On a Collection of Young Holothurioids," by Professor E. W. Macbride; on the Polychæta, by Professor Dr. E. Ehlers, and on the freshwater algæ, by Dr. F. E. Fritsch, these being the only freshwater organisms obtained by the expedition.

The series comprises altogether some fifty memoirs descriptive of the fauna and flora of the Antarctic region. This area, like other cold seas, teems with species, of which 227 new forms have been described in these volumes. Of some Amphipod Crustacea 10,000 to 30,000 were occasionally taken at a single haul and in the collection one species of Schizopod is represented by nearly 10,000 specimens. The great kelp (*Lessonia*) has a frond as much as 24 feet long, but the mosses show signs of degeneration. No evidence in favor of the theory of "bipolarity" has been gathered from the collection. Twenty-three new genera of animals, and 201 new species were obtained, and 26 new species of plants. The collection of young echinoderms includes free-swimming larvæ of three out of four groups of echinoderms, which is of interest in view of the opinion, which had been expressed, that all species of the polar seas would be found to have development of the shortened type without free larvæ.

The freshwater algæ are exceptionally numerous in species, 91 in all, belonging to 35 genera, of which 25 species are Diatoms. Huge sheets of *Phormidium* and occasionally of *Lyngbya* flourish in the ice and during the milder portion of the year in the waters of the ponds and lakes. These sheets serve as a substratum for a rich growth of other forms and are probably the breeding places for the bulk of the algal flora. The scarcity of green algæ is notable, while Diatoms are rather scarce, but desmids are relatively abundant. *Microcystis* sometimes colored the ice of a dull brick red. The conclusion is reached that reproduction in the bulk of the Antarctic algæ is a very slow process and possibly several seasons elapse before a new generation reaches maturity.

The plates of this volume attain the same high degree of excellence noticeable in the previous issues of the series, and a convenient index to the whole set is included both for authors and subjects.

Expédition Antarctique Française, 1903–1905, Commandée par le docteur Jean Charcot. Hydrographie-Physique du Globe, par A. MATHA et J. J. REY. Paris, Bureau des Longitudes. 1911. 4to. Pp. vi + 615, 9 plates, with figures in the text.

The expedition of Dr. Charcot on the schooner *Francais* was due to the enthusiasm of its leader and the generosity of private individuals aided by the efforts of the Parisian journal *Le Matin;* through which after a hard struggle something less than $100,000 was obtained, a small three-masted schooner built, and outfitted for two years. Instruments and books were lent, the members of the party served freely or for a nominal wage,

and the official Bureau des Longitudes took the expedition under its motherly wing and has now published the volume of which the title is above cited.

This expedition was scientific in its aims and pole hunting formed no part of its program. The staff comprised five members beside the leader, with a crew of fourteen; all provinces of France were represented.

The plan of the leader was, in brief, to take up the work inaugurated by the *Belgica* expedition and extend it by explorations of the southwest part of Graham Land, investigating in all branches of science as well as geography, so far as their personnel and equipment would permit.

This program was carried out in its main features. The present volume includes an introduction in which a brief résumé of previous researches in the same region is given, after which the hydrography, tides, chronometric record, pendulum observations and the density and salinity of the seawater, are discussed by Lieutenant Matha, atmospheric electricity, meteorology and terrestrial magnetism by Lieutenant Rey. The work is carefully printed and the charts are of the quality one expects from the bureau which issues the volume.

Wm. H. Dall

SPECIAL ARTICLES

A CASE OF SEX-LINKED INHERITANCE IN THE DOMESTIC PIGEON[1]

In breeding work with tumbler pigeons begun at the Rhode Island Agricultural Experiment Station some years ago a careful study was made of the manner of inheritance of certain of the commoner colors of these birds, especially black, dun, red, yellow, blue and silver. This work was referred to in the Twenty-first Annual Report of the Station, 1908, p. 301, and a full report of the results, it is expected, will be published during the present year. These experiments made clear the fact that dun, yellow and silver are dilute conditions of black, red and blue, respectively. Indeed, this might have been surmised from their appearance, but the fact was substantiated by their behavior in the breeding tests. As has been found in other animals, notably in rabbits and mice, the dilute condition depends upon a single factor, or more strictly the absence of a factor, which produces the effect upon whatever color it chances to be associated with. In other words, "intense" is dominant to "dilute," that is, if the factor for the intense condition is present, the color of the bird takes that appearance. This relationship, in the case of blue and silver, has been pointed out by Bonhote and Smalley (p. 603).[2]

Although the earlier experiments showed the general relationships of these characters, it was only by the results of certain experiments of the past year that the interesting relationship of the intense and dilute condition to sex has come to light. No secondary sex characters (in the ordinary sense) exist in pigeons, and as a consequence there is no way of determining the sex of the birds until they are old enough to reveal it by their behavior. In the case of certain crosses made last year, in which the male parent was a dilute (yellow or dun) and the female a black baldhead,[3] both black and dun offspring were produced, and it became evident this spring that all the blacks were males, while all the duns were females. The following examples will serve to illustrate.

Case I.

Parents:	♂ 540 B, dun
	♀ 647 A, black baldhead.
Offspring:	790 A, black, ♂
	790 B, black, ♂
	847 A, dun, ♀
	893 A, black, ♂
	893 B, dun, ♀
	954 A, dun, ♀

[1] Contributions from the Laboratory of Experimental Breeding, Wisconsin Agricultural Experiment Station, No. 1.

[2] Bonhote and Smalley, "On Color and Color-pattern Inheritance in Pigeons," *Proc. Zool. Soc.*, London, 1911, pp. 601–619, Pls. XXIII.–XXVI.

[3] In this discussion pattern is disregarded, since it is due to independent factors with which we are not at present concerned.

Case II.

Parents: ♂ 473 A, yellow
♀ 650 A, black baldhead

Offspring: 799 A, dun, ♀
799 B, dun, ♀
841 A, black, ♂
890 A, dun, ♀
890 B, dun, ♀
938 B, dun, ♀
980 A, dun, ♀

A search of the records for other cases furnishes abundant evidence to indicate that the phenomenon is general, and under certain conditions holds for the intense and dilute factors, whatever the color concerned. The requisite conditions appeared to be the mating of a dilute male to a female showing the intense condition. Further investigation showed that this is a typical case of sex-linked inheritance in that in stock bred pure for the character in question one sex is always heterozygous. In this case it is the female which is heterozygous, the character involved being the intense condition of pigmentation. In respect to the sex concerned this character corresponds to barring in the fowl and to color in *Abraxas*, and differs from color blindness in man and the numerous sex-linked characters which Morgan has found in *Drosophila*. These results have furnished a satisfactory explanation of certain formerly disquieting records in which birds bred "pure" and supposedly homozygous for the intense condition have produced some dilute offspring when bred with heterozygous or with dilute mates. It is now found that in all such cases noted the birds in question were females and, furthermore, that all the dilute offspring, so far as at present observed, were likewise females. A thorough analysis of the subject is now being made and the detailed results will be published in the near future.

The results mentioned above may be satisfactorily represented by either of the accepted modes of symbolism which have been employed in similar cases. Without committing ourselves to any theory, we may here follow the usage of Spillman and of Pearl in explaining the inheritance of barring in poultry. In these formulæ F represents femaleness, and the female is always heterozygous (Ff) with respect to this factor. Males, on the other hand, are assumed to lack this factor entirely, and are accordingly homozygous ff. We may then let B represent the factor for black, in the absence of which (b) the bird is red. These colors are modified, however, by the presence or absence of I, the factor for the intense condition. In the absence of I (represented by i) black becomes dun, and red becomes yellow. It is now necessary to make only the further assumption that F and I can not occur together in the same gamete. The cases given may then be represented as follows:

Case I.

Parents: dun ♂ $= fBi.fBi$
black ♀ $= fBI.FBi$
Gametes: ♂, all fBi
♀, fBI and FBi
Combinations: $fBi.fBI$ = black ♂♂
$fBi.FBi$ = dun ♀♀

Case II.

Parents: yellow ♂ $= fbi.fbi$
black ♀ $= fBI.FBi$
Gametes: ♂, all fbi
♀, fBI and FBi
Combinations: $fbi.fBI$ = black ♂♂
$fbi.FBi$ = dun ♀♀

It will be seen that these expectations accord with the results obtained.

It has been mentioned that this explanation accounted also for certain unexpected results from birds which were at the time supposedly homozygous. A single example will suffice.

Parents: ♂ 681 B, black
♀ 701 A, red

Offspring: 846 B, yellow, ♀
892 A, red, ♂
892 B, dun, ♀
944 A, black, ♂
944 B, black ♂

It was known from his ancestry that 681 B was heterozygous, both with respect to B and I. But had 701 A been homozygous for I, as supposed, all the offspring should have shown the intense condition of pigmentation, namely,

black and red. The unexpected appearance of the dun and yellow birds is satisfactorily accounted for on the assumption that she was heterozygous, as follows:

Parents: black ♂ = *fBI·fbi*
red ♀ = *fbI·Fbi*
Gametes: ♂, *fBI, fBi, fbI* and *fbi*
♀, *fbI* and *Fbi*
Combinations: *fBI·fbI* = black ♂
fBI·Fbi = black ♀
fBi·fbI = black ♂
fBi·Fbi = dun ♀
fbI·fbI = red ♂
fbI·Fbi = red ♀
fbi·fbI = red ♂
fbi·fbi = yellow ♀

That is, 2 black males: 1 black female: 2 red males: 1 red female: 1 dun female: 1 yellow female.

While the number of offspring is too small on which to base any conclusion as to proportions, it will be noted that all so far obtained fall in line with the expectations as to color and sex.

The foregoing may provide an explanation of the interesting observations of R. M. Strong on the sex of ring-doves,[4] and those of Bonhote and Smalley (*loc. cit.*, p. 617, footnote), as well as possibly those of Whitman reported by Riddle.[5]

[P. S., July 22, 1912. Since the foregoing note went to press there has appeared in the June, 1912, number of the *Journal of Genetics* (Vol. 2, No. 2, p. 131) a paper by Mr. R. Staples-Browne, in which the relation of blue and silver to sex is amply demonstrated.]

Leon J. Cole

The Intertubercular or Bicipital Foramen of the Humerus of the Guinea-pig

The upper extremity of the humerus of the guinea-pig often has an unusual, probably an unique, structure. A broad and thick bridge connects the large and small tubercles and converts the intertubercular sulcus into a foramen through which passes the tendon of origin of the *m. biceps*. At the last meeting of the Association of Anatomists, I reported that among twenty skeletons studied, four humeri from three individuals, two males and one female, were found which had this peculiar structure. Recently, through the kindness of Professor Castle and Dr. Detlefsen, of the Bussey Institution, I have been allowed to study their large collection of guinea-pig skeletons and was surprised to find the remarkable prevalence of the intertubercular foramen. Out of a total of 125 humeri, 17, 13.6 per cent., have complete foramina. Besides these 23 others, 18.4 per cent., have nearly complete bridges over the intertubercular sulci. In six instances, this bridge is formed by a small supernumerary bone which is wedged in between the great and small tubercles; in the others, by small acute processes which project toward each other from the adjacent sides of the tubercles. One or two similar but smaller processes occur upon 50 humeri, 40 per cent. of the total number, the remaining 35 bones, 28 per cent., having no indication of the foramen.

All of the skeletons used are of adult or subadult animals, but as the growth of the guinea-pig continues long after sexual maturity, possibly throughout life, it is probable that had the animals been older, an even larger proportion of complete foramina would have been present.

In all cases, the foramen has the same character. The upper edge of the bridge is convex, its lower edge concave. The canal-like foramen is narrow above, but rapidly widens below and terminates in an oblique, flaring and funnel-shaped mouth which is surrounded by a rough, slightly elevated, lip.

It seems impossible to correlate the occurrence of the intertubercular foramina with sex, age or muscular development. Foramina do not occur in immature animals, but, on the other hand, they are absent in certain very old animals (three or four years old) and furthermore they are occasionally present upon one side only.

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[4] Science, N. S., Vol. 33, p. 266, 1911.
[5] Science, N. S., Vol. 35, p. 462, 1912.